THE AUTOMATED EMOTIONAL MUSIC GENERATOR WITH EMOTION AND SEASON FEATURES

Chih-fang Huang[*], Chi-jung Li[†]

[*]Department of Information Communications, Kainan University, Taiwan
[†]Department of Information Communication, Yuan Ze University, Taiwan
Jeffh.me83g@gmail.com

Abstract

Nowadays, there are various types of automated music generating systems to automatically compose music clips instantly; however, those randomly-generated music clips still sounded uncomfortable and discordant. This paper attempts to add with emotion and season features to assist automated music generating systems based on algorithm, and then tries to make all generative music clips sound with harmonious and emotional meaning to listeners. The automated music generator used in this topic is not only based on algorithm but also adopts Thayer's emotional model as well as four season factors, so all music clips will not only express unique music emotions but also indicate all seasons which may match to equivalent emotions. In the experiments for this automated music generator, the resultant music is generated from high-valence presets presented as positive emotions and warmer seasons, while the opposite side presented as negative seasons as well as colder seasons. Furthermore, this kind of automated music generator can be used at the occasion of children or elders' caretaking so that the children or elder people's mood would be cheered up while listening to those enlightened music clips generated by the proposed music generator.

Keywords: algorithm, automated music generator, emotion, season

Preface

Composing and playing music scores and songs automatically is always the direction everyone struggling for, and people who expert in music and computer work together to develop systems which could automatically and randomly generate music clips. They tried to utilize their in-depth studies in music composition, algorithm, programming and user interface design altogether, and then began to develop an automated music generator which includes generating random music clips that based on algorithm. Since automated music generator seems to be difficult for ordinary users, it is very important to reduce the difficulty of operating progress, complexity of user interface, and generate melodic music clips.

Another issue in this article is season factors. Different seasons may affect or reflect users' moods, and the automated music clips perform as well; one of the typical examples is *The Four Seasons* by Antonio Vivaldi, he depicted four unique features on each season, like the chilling *Winter* and the stormy *Summer* movements (Wikipedia, 2013a). These images of each season are transformed into melodic symphonies, and people may reflect their emotions by playing the music, just like Vivaldi did before.

1. Reference Reviews

1.1. Automated Music Generator

The automated music generator is the primary issue in this article, and people will use this kind of system to generate random emotional

music clips in a few seconds. This way can help users to create their favorite music clips easily, and randomly-generated music clips will show different melody, and they would feel the new, different types of music clips every time.

These automated music generators use algorithm as the foundation stone of the whole process for generating music clips. A commonly used algorithm is based on valence-arousal plane (a.k.a. Thayer's plane), and both factors may affect the algorithm to generate music (Campana, Ingalls, & Wallis, 2008). On the other hands, both of valence and arousal factors would affect human emotions, and features of different emotions will play the role on all four quadrants on the valence-arousal plane; the emotional value on the X-axis (valence) indicates positive or negative moods of a person; while Y-axis (arousal) reflects the intensity of a person's mood. For the emotional mappings to the valence-arousal plane, the first quadrant (high-valence, high-arousal) indicates a people is in a highly delightful mood, while the mood on the second quadrant (low-valence, low-arousal) may display a person whose emotion is in a deep grief. Other opposite quadrants of emotional signs are totally different to the normal states.
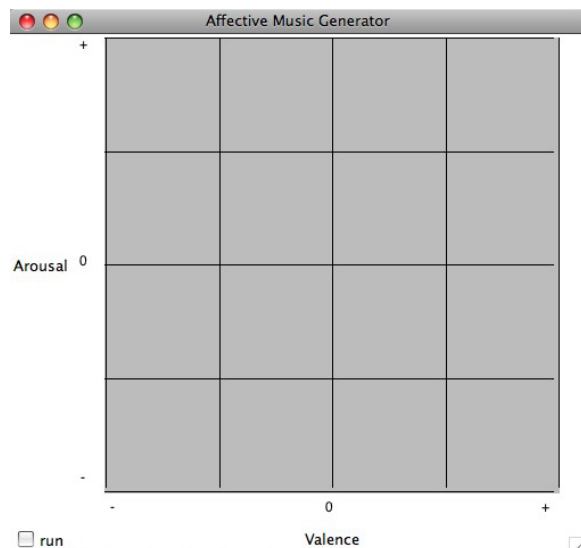

Figure 1. Valence-arousal plane
Note. From Campana, E., Ingalls, T., & Wallis, I. (2008). Computer-generating emotional music: the art of an affective music alghorithm. *11th Conference on Digital Audio Effects* (pp. 7-12). Espoo, Finland: Helsinki University of Technology.

In Berg and Wingstedt's (2005) study on music emotions, they analyzed several music parameters and mapped them into happy or sad emotions, and listed all musical features on each parameter.

Table 1. The mappings of happiness/sadness emotional expressions to musical parameters

Parameters	Happiness emotion	Sadness emotion
Articulation	Staccato	Legato
Harmony	Simple and consonant	Complex/dissonant
Loudness	Loud	Soft
Melodic range	Wide	Narrow
Melodic direction	Ascending	Descending
Mode	Major	Minor
Pitch level	High	Low
Rhythm	Regular/smooth	Firm
Tempo	Fast	Slow
Timbre	Few harmonics	Few harmonics/soft

Note. Revised from Berg, J., & Wingstedt, J. (2005). Relations between selected musical parameters and expressed emotions: extending the potential of computer entertainment. *2005 ACM SIGCHI International Conference on Advances in computer entertainment technology* (pp. 164-171). New York, NY: ACM.

1.2. Season Factors

All four unique seasons are factors to affect everyone's emotions, and the scenery of each season could be transformed into the music. *The Four Seasons* suite composed by Baroque–style musician Antonio Vivaldi is the classical music accomplishment to describe all four seasons vividly. (Wikipedia, 2013b) Also, each scene of all four seasons could be implemented onto the automated music generators, as the mapping onto four quadrants of the valence-arousal plane.

Spring feature may be mapped onto the first quadrant, and it could present the image filled with harmonious and delightful mood in positive valence and high arousal; summer feature performs ever-changing weathers like thunderstorm and tempest during the summer, and it would reflect angry and violent

emotions; in the autumn feature, the tempo and temperature become lower, and the emotion would act as slow and wild; the chilling and snowy winter would make people's mood become very down and low.

2. Research Methodology

In this project, experiments on the automated music generator and survey on the users are necessary, and then collect questionnaire as users' response to the automated music generator. On one hand, the automated music generators may add on with season features; and on the other hand, conducting an online survey will quickly and efficiently retrieve users' opinions to the automated music generators with season features. The experiment will try to find the influence of season factors on automated music generators.

3. Experiments and Statistics

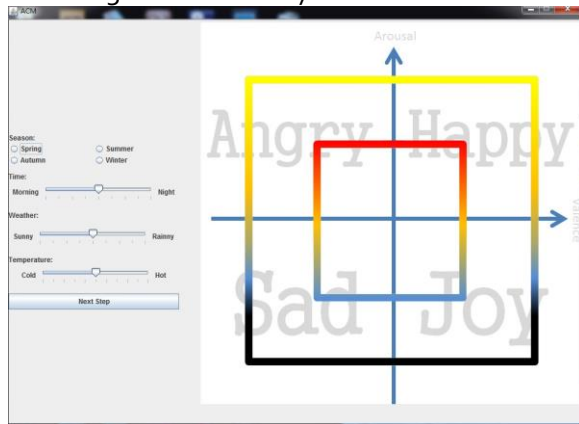At first, the automated music generator with seasonal features has been introduced for the following test and survey:

Figure 2. User interface of the automated music generator

The first step is clicking either season, and then dragging the scroll bar to adjust weather, time and temperature parameters, the light dots will appear on the valence-arousal plane to adjust designated emotion zone; the last step is clicking the "start" button. A randomly-generated music clip based on algorithm will be played soon afterwards.

This experiment had been undergone at the Gerontechnology Research Center of Yuan Ze University, and initially tested by the staff and assistants, and then the volunteer elders, their relatives and other people were invited to do this survey. Also, their response to this system had shown below:

Table 2. Experimental statistics

Coordinates	Season factors
1st quadrant (high-valence, high-arousal)	Spring (69), Summer (37), Autumn (28), Winter (16)
2nd quadrant (low-valence, high-arousal)	Spring (43) ,Summer (82), Autumn (17), Winter(8)
3rd quadrant (low-valence, low-arousal)	Spring (21), Summer (14), Autumn (48), Winter (63)
4th quadrant (high-valence, low-arousal)	Spring (25), Summer (22), Autumn (56), Winter (47)

In the above table, the highest vote of all four seasons within all four quadrants indicated which season could be the most dominating one in different valence or arousal values on the 2D emotional plane.

4. Results and Discussion

4.1. Reviews of the Result

According to Table 1, each quadrant clearly has shown one of the all four seasons: spring is mapped to the 1st quadrant (69/150 people), summer is mapped to the 2nd quadrant (82/150 people), autumn is mapped to the 4th quadrant (56/150 people), and winter is mapped to the 3rd quadrant (63/150) people. For the maximum value of each quadrant and its equivalent season, summer had 82 votes, and this sign indicated that summer displayed the strongest influence on automated music generator with season features; while autumn, which had 56 votes, displaying the least influence on this system.

4.2. Future Works

From the above experiment, season factors on the automated music generator is still have a room to improve the composing style representing all four seasons in all generated music clips properly, and there will be a long way to make all generated music clips sound vivid and harmonious like Vivaldi had done.

Nowadays, several types of automatic theme music composing software could generate music clips with season features, like "Band-in-a-Box" (Wikipedia, 2013c), users can select the assigned season category, and then generate a music clip with the season feature; but this software uses its internal pre-recorded MIDI clips to put together and then generate a music clip. The way to generate a beautiful music with season factors will be a future goal to be done.

References

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